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# An Assessment of Acquisition Outcomes and Potential Impact of Legislative and Policy Changes

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# **An Assessment of Acquisition Outcomes and Potential Impact of Legislative and Policy Changes**

**Presentation by  
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**Naval Post Graduate School  
6<sup>th</sup> Annual Acquisition Research Symposium  
Monterey, CA  
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## Presentation Objectives

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- **Provide observations** on the Department's efforts to manage its 2009 portfolio of major weapon system programs, performance of newer programs, and ability to deliver to the warfighter on time
  - **Analyze outcomes** and knowledge attained at key junctures in the acquisition process for a subset of the 42 programs primarily still in development
  - **Gather data on other factors** that might impact program stability and outcomes such as: cost estimating, requirement setting, software management, and program office staffing
  - **Provide an update** on any impacts from DOD acquisition policy changes and Congressional acquisition reform legislation
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## Observations on DOD's Fiscal Year 2009 Major Defense Acquisition Program Portfolio

- DOD's major defense acquisition portfolio grew to 102 programs in July 2009 - a net increase of 6 programs since December 2007.
- Eighteen programs in the portfolio are newly designated major defense acquisition programs. The total acquisition cost of the thirteen new programs with cost data is over \$72 billion.
- Twelve programs with a cost of \$48 billion, including \$7 billion in cost growth since their first estimate, left the portfolio. If FCS is included, these numbers increase to \$179 billion and \$48 billion respectively.
- The lack of complete Selected Acquisition Reports in 2009 precluded a definitive analysis of the overall cost and schedule performance of the portfolio.

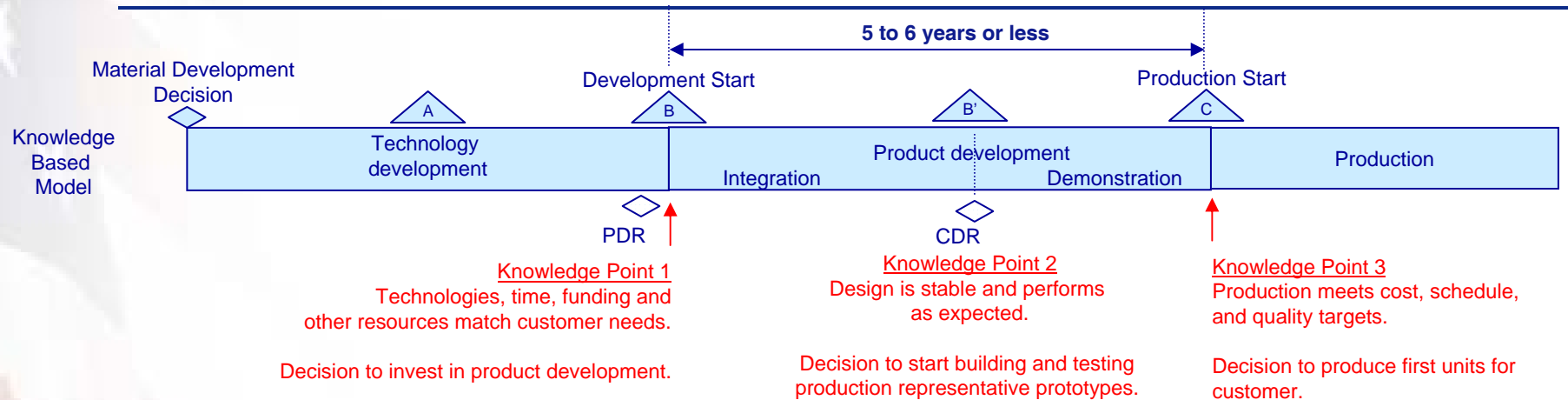
# Observations on DOD's Fiscal Year 2009 Major Defense Acquisition Program Portfolio

- The Secretary of Defense's fiscal year 2010 budget recommended canceling or curtailing all or part of at least a half dozen major defense acquisition programs, including CSAR-X, DDG 1000, FCS, and VH-71.

	Weapon system	Secretary's comments
Recommended terminations	VH-71 Presidential Helicopter	Plan to develop options for new program
	Combat Search and Rescue Helicopter	Plan to reexamine requirements
	Next-Generation Bomber	Will not initiate new development program without better understanding of requirements and technology
	Future Combat Systems–Manned Ground Vehicles	Plan to reevaluate requirements, technology, and approach before relaunching and recompeting program
	Transformational Satellite	Plan to buy two more AEHF satellites as alternative
	Ballistic Missile Defense–Multiple Kill Vehicle	Plan to reexamine requirements; no mention of new program
Recommended end of production	C-17	Recommended ending production at 205 aircraft
	DDG 1000	Recommended ending production at 3 ships
	F-22	Recommended ending production at 187 aircraft.

Source: GAO analysis of DOD data.

# A Knowledge-Based Approach is Key to Successful Program Outcomes



- Model provides framework for incremental, time certain (development constrained to 5 to 6 years or less), and knowledge-based approach to weapon system acquisitions.
- Success requires structured, disciplined application and adherence to model.
- Knowledge points align with key investment inflection points.
- Controls are in place for decisions makers to measure progress against specific criteria and ensure managers capture key knowledge before moving to next phase.

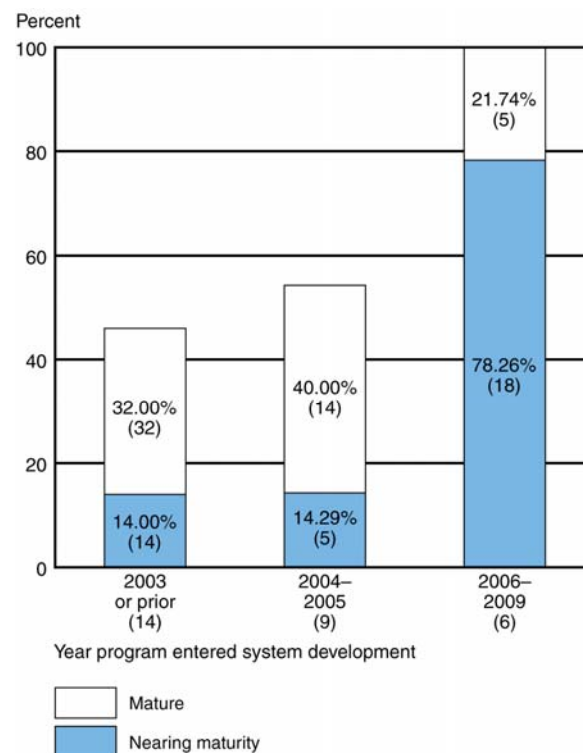
## Programs Conducting Early Systems Engineering Have Better Outcomes

- Early systems engineering, ideally before a program enters development, is critical to ensuring that requirements are achievable and designable.
- We have previously reported that programs conducting key systems engineering events prior to development start experienced, on average, lower cost growth and shorter delays in achieving initial operational capability.
- Only 1 of the 37 programs in our 2010 assessment that held PDR did so before development start. The remaining programs, on average, held the review 30 months after development start.
- Preliminary design review now required prior to development start under the Weapon System Acquisition Reform Act of 2009.

## Newer Programs GAO Assessed Are Starting with Higher Levels of Technology Maturity

- Since 2003, there has been an increase in the maturity of critical technologies at development start.
- All 6 programs entering system development from 2006 to 2009 had their critical technologies demonstrated in at least a relevant environment, in accordance with the DOD and statutory criteria.
- However, only 4 of the 29 programs in our 2010 assessment that provided data started development with fully mature critical technologies.

Maturity of Critical Technologies at Milestone B



Source: GAO analysis of DOD data.

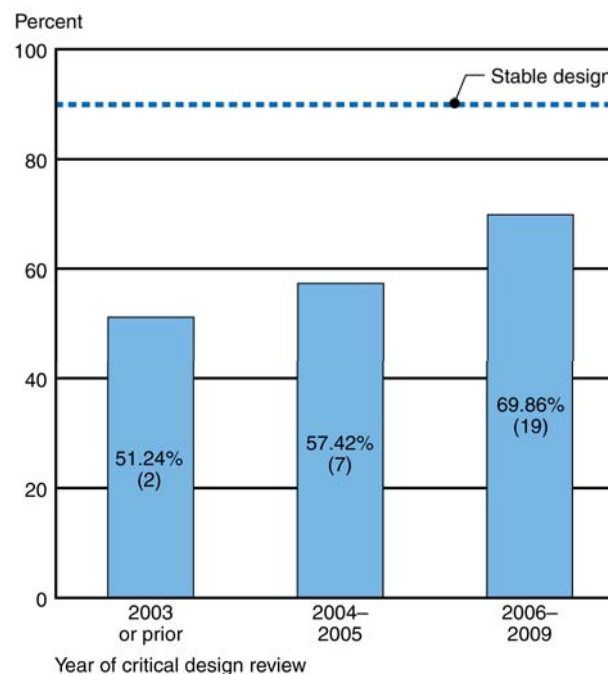
Note: Number of programs and technologies in parentheses.



## Programs Holding Design Reviews in Recent Years Reported Having More Knowledge

- Since 2003, the average percentage of design drawings releasable for programs at the critical design review has steadily increased.
- However, designs, on average, are still far from stable and concurrent technology development increases the risk subsequent design changes and rework.
- Of the 28 programs in our 2010 assessment that held a critical design review, only 8 reported having a stable design.

Average Percent of Releasable Design Drawings at Critical Design Review



Source: GAO analysis of DOD data.

Note: Number of programs in parentheses.

# Programs Are Not Testing Prototypes in Time to Prove Out Designs and Performance

- Programs should test integrated prototypes before critical design review to demonstrate that the design is capable of meeting requirements.
- Only 4 of 33 programs in our 2010 assessment tested or planned to test an integrated prototype before critical design review. The remaining programs reported that they will test these prototypes, on average, 31 months later.

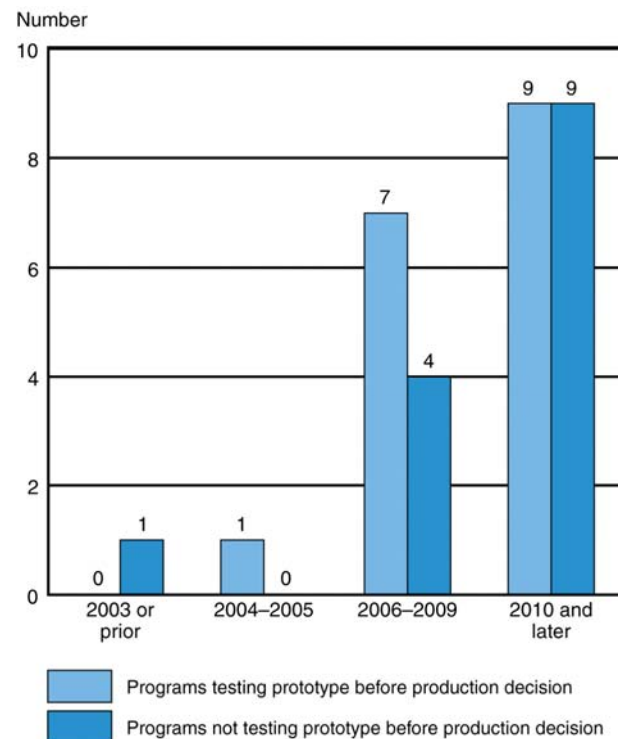
	Year of critical design review				
	2003 or prior	2004-2005	2006-2009	2010 or later	All programs
Number of programs testing before critical design review	1	0	3	0	4
Number of programs testing after critical design review	3	6	15	5	29
For programs testing after critical design review, average number of months from design review to prototype test	74	29	27	18	31

Source: GAO analysis of DOD data.

## Programs Are Not Demonstrating Performance or Manufacturing Processes Before Production

- Programs should test production representative prototypes before production start and bring critical manufacturing processes into statistical control.
- Only 17 of the 31 programs in our 2010 assessment that reported a production date have tested or planned to test a production representative prototype before production.
- Only 7 programs in our 2010 assessment had identified their critical manufacturing processes.

**Programs Testing Production Representative Prototype Before and After a Production Decision**



Source: GAO analysis of DOD data.

## Observations on Other Factors That Can Affect Program Execution

- **Requirements:** Of the 42 programs in our 2010 assessment, 23 programs reported at least one change to a key performance parameter and 9 programs experienced at least one change to a key systems attribute since development start.
- **Software:** Seventeen of the 28 programs that reported software data estimated that software lines of code had grown by 25 percent or more since development start. The average lines of code growth was 92 percent.
- **Program office staffing:** Nineteen of 50 programs that responded to our staffing questions were able to fill all authorized positions. As a result, program offices reported that program management and oversight had been degraded, contracting activities had been delayed, and program management costs had increased as contractors were used to fill gaps.

## Observations on Other Factors That Can Affect Program Execution

- Programs' reliance on non-governmental personnel continues to increase in order to make up for shortfalls in government personnel and capabilities.

### Program Office Composition for 50 DOD Programs

	Program management	Engineering and technical	Contracting	Other business functions	Administrative support	Other	Total
Military	28%	7%	6%	3%	2%	5%	8%
Civilian government	40%	41%	74%	45%	18%	24%	40%
<b>Total government</b>	67%	47%	80%	48%	20%	29%	49%
Support contractors	32%	43%	20%	50%	78%	70%	45%
Other nongovernment	0%	9%	0%	3%	2%	1%	6%
<b>Total nongovernment</b>	33%	53%	20%	52%	80%	71%	51%

Note: Totals may not add due to rounding.

Source: GAO analysis of DOD data.

# New DOD Policies Could Improve Outcomes

- **Recent department initiatives may help focus on joint warfighter needs**
  - Functional COCOMs given greater voice in requirements process.
  - Preferred materiel solutions no longer identified in initial capability proposals, giving greater emphasis to trade-off analysis via AOA.
- **New Capability Portfolio Management framework could facilitate more strategic investment choices**
  - Portfolio managers provided key input in recent budget cycle, but they do not have decision-making authority.
- **More discipline and up-front knowledge in early acquisition phases could put programs on more stable footing**
  - Early Materiel Development Decision required for all programs.
  - Preference for incremental development, with baselines for each increment.
  - PDR required before system development start.
  - Competitive prototyping required as part of technology development phase.
  - Configuration Steering Boards established to control requirements creep.

# Weapon System Acquisition Reform Act Stresses Cost and Performance Assessment

- **Elevates the role of cost assessment and program evaluation**
  - Duties of Director, Cost Assessment and Program Evaluation (CA&PE) include reviewing cost estimates, conducting independent cost estimates, and approving the choice of baseline cost estimates for all ACAT ID programs.
  - Director, CAPE, will also formulate study guidance for analysis of alternatives.
- **Emphasizes importance of systems engineering and developmental test**
  - Established Directors of Developmental Test and Evaluation and Systems Engineering to oversee policy and guidance and approve test and systems engineering plans.
  - Requires services to periodically assess their capabilities in these areas.
- **Increases oversight and reporting on cost estimating, systems engineering, developmental test, program performance, and technology maturity.**
- **Stresses importance of competition throughout the acquisition cycle.**

## Programs Have Begun to Implement DOD's Revised Acquisition Policies

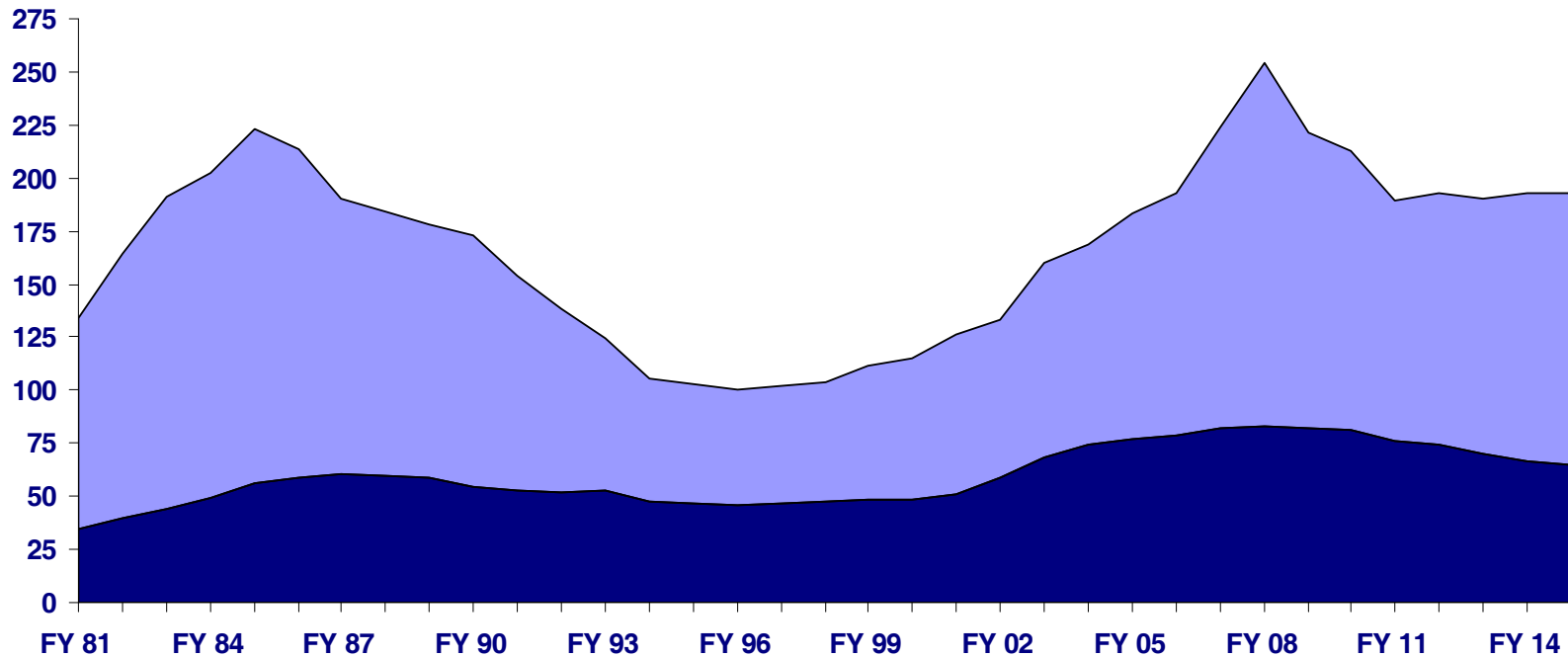
- **Programs in our 2010 assessment have begun to implement acquisition reforms that could improve cost and schedule outcomes.**
  - Competitive prototyping – 8 of 10 pre-major defense acquisition programs in our assessment reported planning to develop competitive prototypes of the proposed weapon system or key system elements prior to Milestone B.
  - Early systems engineering – 7 of 10 pre-major defense acquisition programs in our assessment have already scheduled a preliminary design review before Milestone B.
- **Only a few programs in our 2010 assessment reported holding configuration steering board meetings in 2009.**
  - For 7 programs that held meetings in 2009, none reported that the board approved a requirement change or significant technical change.
  - One program presented de-scoping options to the board and had those approved to help maintain cost and schedule.



## Backup Slides

# DOD Investment Levels Remain High, But Are Not Sustainable

Fiscal year 2011  
dollars in billions



**Research, Development, Test and Evaluation and Procurement Funding**

Source: GAO analysis of National Defense Budget Estimates for the Fiscal Year 2011 Budget.

# DOD's Major Defense Acquisition Portfolio Has Experienced Poor Outcomes

## Performance of DOD's Major Defense Acquisition Program Portfolio

Portfolio status	Fiscal year 2003	Fiscal year 2007	Fiscal year 2008
Number of programs	77	95	96
Total planned commitments	\$1.2 trillion	\$1.6 trillion	\$1.6 trillion
Commitments outstanding	\$724 billion	\$875 billion	\$786 billion
Change to total RDT&E costs from first estimate	37 percent	40 percent	42 percent
Change in total acquisition cost from first estimate	19 percent	26 percent	25 percent
Estimated total acquisition cost growth	\$183 billion	\$301 billion	\$296 billion
Share of programs with 25 percent or more increase in program acquisition unit cost	41 percent	44 percent	42 percent
Average delay in delivering initial capabilities	18 months	21 months	22 months

Note: Analysis was not updated for the fiscal year 2009 because DOD did not issue Selected Acquisition Reports.

# New Programs Are Performing Better Than Older Programs

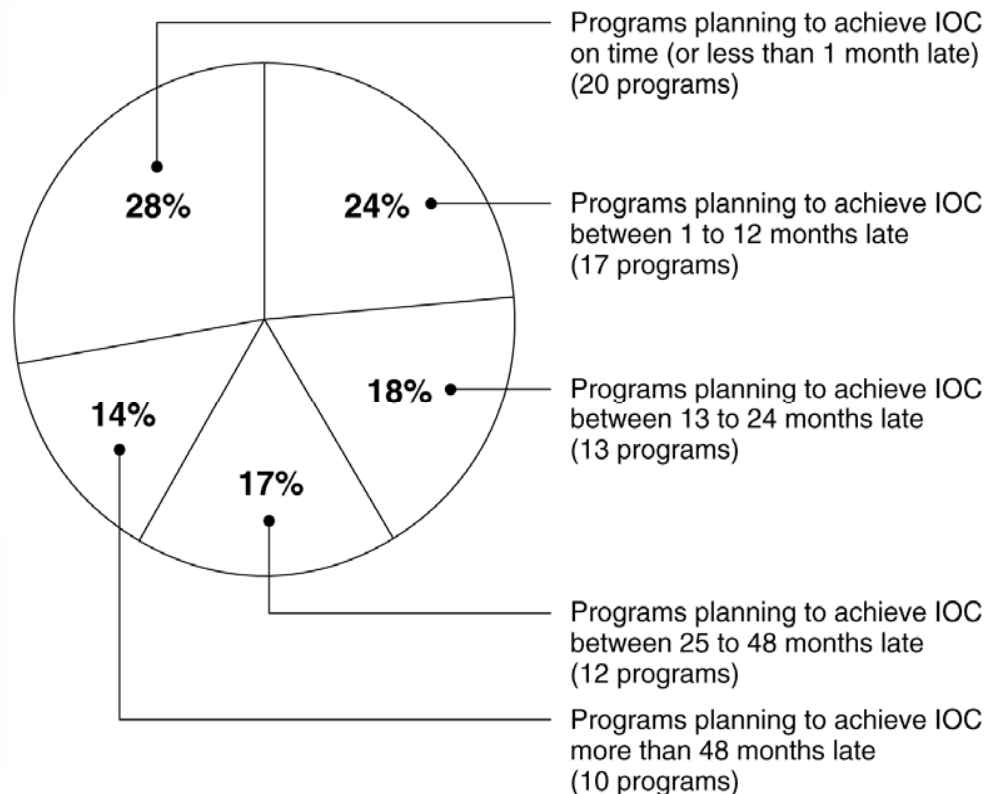
## Changes in Program Cost and Schedule by Age of Program Fiscal Year 2008 Portfolio

Age of Program	Change in total RDT&E costs from first estimate	Change in total acquisition cost from first estimate	Average change in quantities	Average number of months late	Number of programs
15 or more years since development start	47 percent	19 percent	-39 percent	37 months	10
10 to 14 years since development start	73 percent	53 percent	52 percent	26 months	17
5 to 9 years since development start	37 percent	31 percent	9 percent	22 months	25
Less than 5 years since development start	12 percent	11 percent	1 percent	5 months	28

Note: Analysis was not updated for the fiscal year 2009 because DOD did not issue Selected Acquisition Reports.

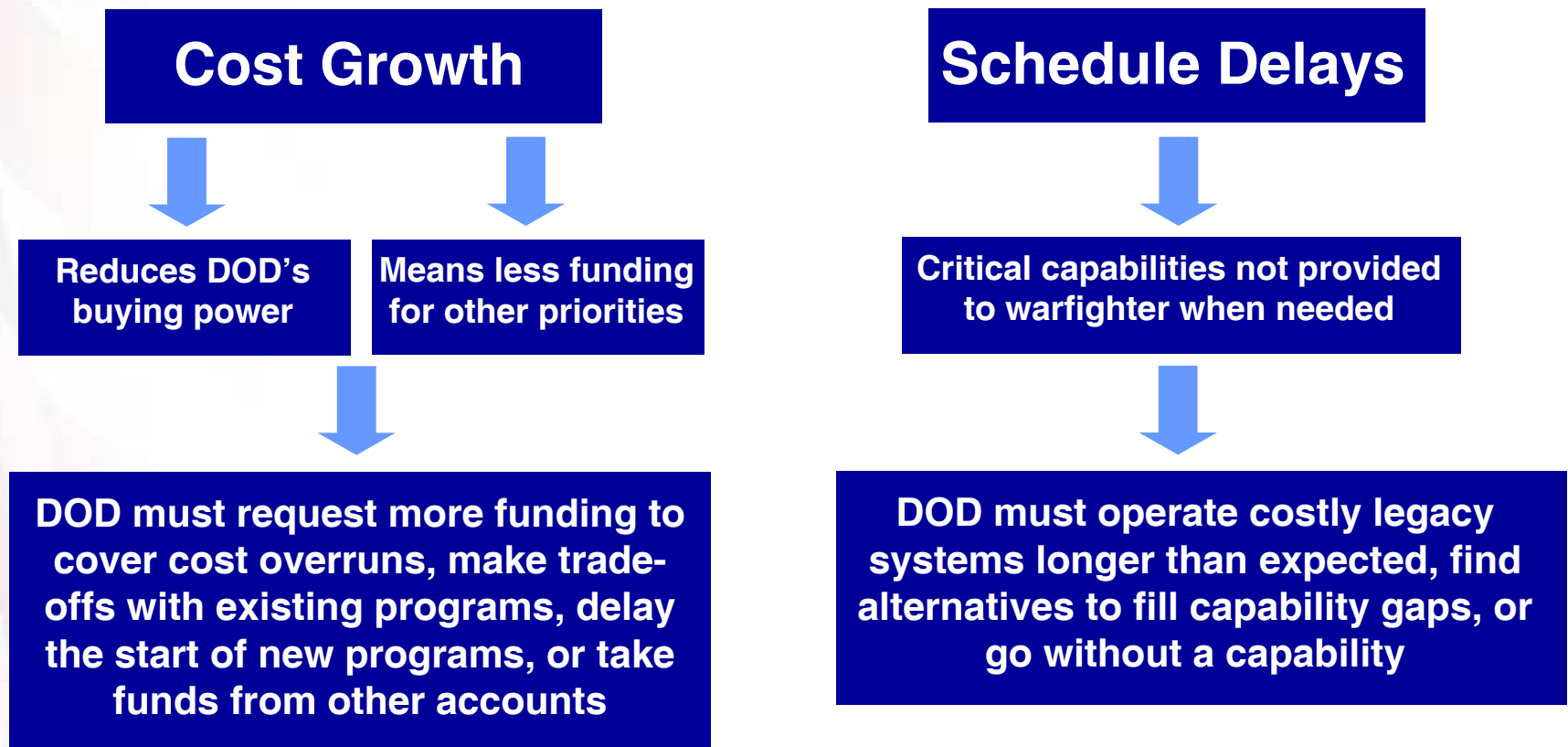
# Promised Capabilities Are Delivered Later Than Planned

## Schedule Delays for DOD's 2008 Program Portfolio

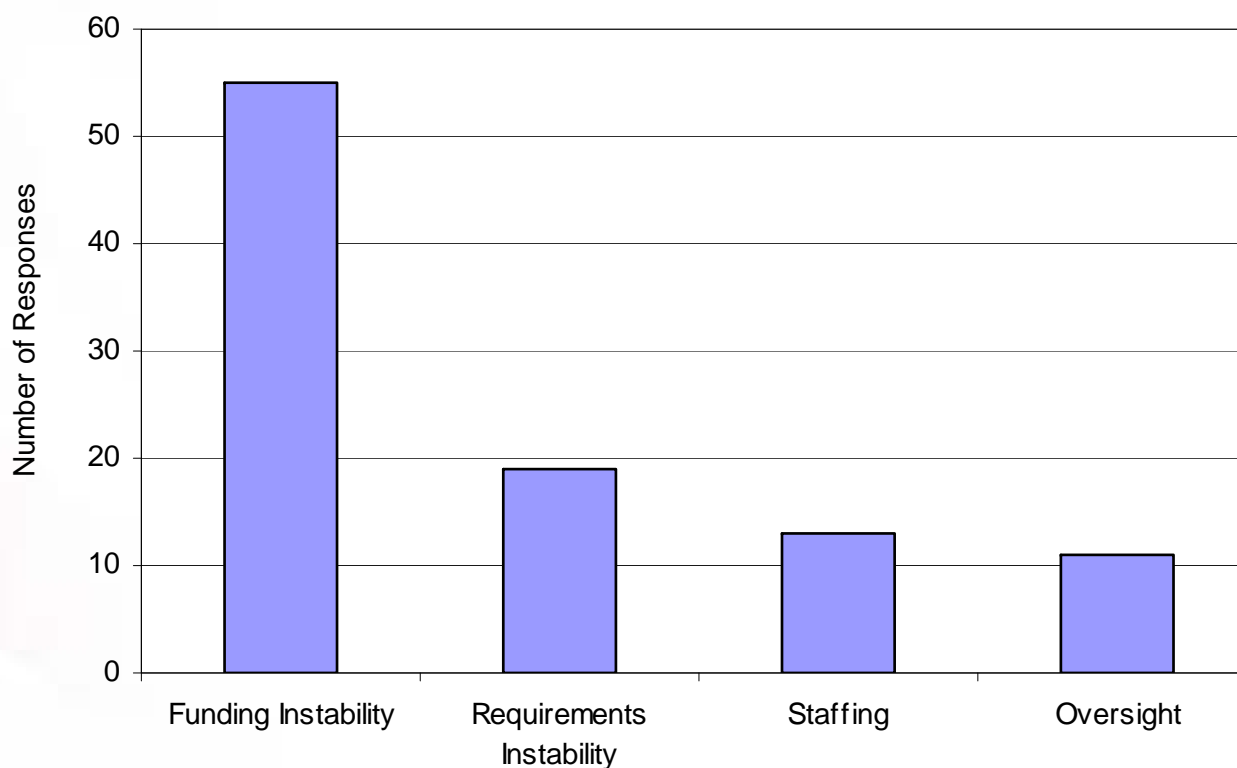


Note: Analysis was not updated for the fiscal year 2009 because DOD did not issue Selected Acquisition Reports.  
Source: GAO analysis of December 2007 Selected Acquisition Reports.

## Consequences of Poor Outcomes



## Program Managers Cited Requirements and Funding as Biggest Obstacles to Success



Source: GAO-06-112SP.

# Strategic and Program Level Factors Lead to Poor Outcomes

## STRATEGIC LEVEL

- DOD's processes for determining warfighter needs, allocating resources, and managing acquisition programs are fragmented
- Success defined in terms of starting and sustaining programs

## PROGRAM LEVEL

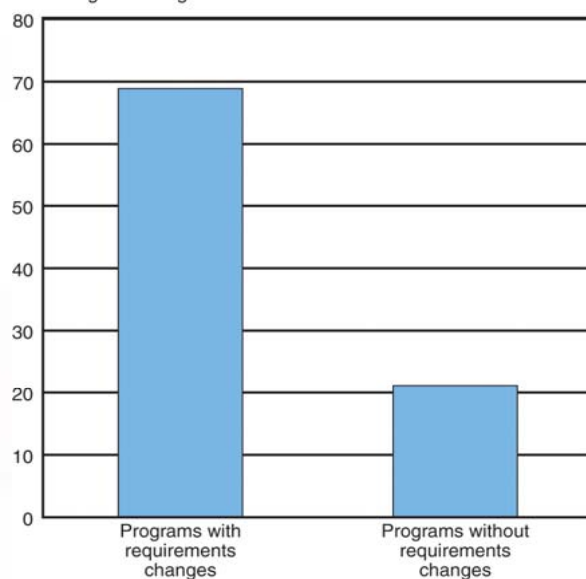
- Programs are proposed and approved without adequate knowledge about requirements and resources needed to execute them
- Managers rely on optimistic assumptions about requirements, technologies, cost, and schedule



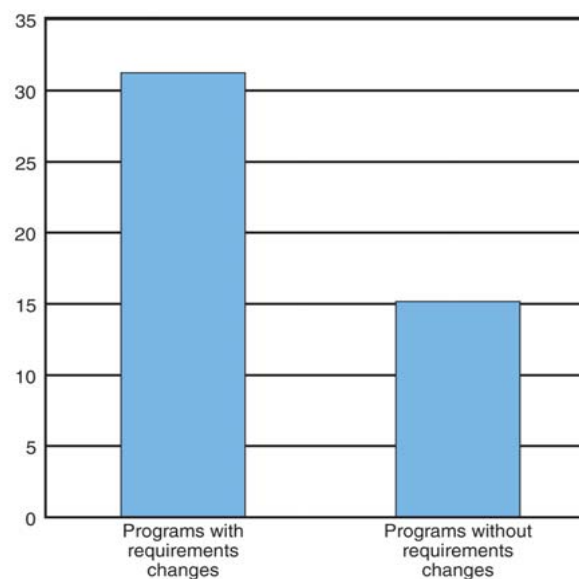
## Programs that Changed Key Requirements Experienced Added Instability

- For programs in our 2009 assessment that had at least one requirements change, the average RDT&E cost was more than three times higher and the average schedule delay was twice as long as programs without these changes.

Percentage of change in RDT&E cost



Months



Source: GAO analysis of DOD data.

# Are Effective Controls In Place to Ensure a Knowledge-Based Approach is Followed?

## Knowledge Point 1: Technologies, time, funding, and other resources match customer needs. Decision to invest in product development.

Types of controls considered effective for ensuring knowledge-based approach	Are controls present in DOD 5000 policy?
Demonstrate technologies to a high readiness level - technology readiness level 7 – to ensure technologies will work in an operational environment	I
Ensure that requirements for product increment are informed by preliminary design review using systems engineering process (such as prototyping of preliminary design)	X
Establish cost and schedule estimates for product on the basis of knowledge from preliminary design using system engineering tools (such as prototyping of preliminary design)	X
Constrain development phase (5 to 6 years or less) for incremental development	I
Ensure development phase fully funded (programmed in anticipation of milestone)	I
Align program manager tenure to complete development phase	I
Conduct independent cost estimate	X
Conduct independent program assessment	
Conduct major milestone decision review for development start	X

X = Sufficient controls in place. Controls are considered effective if they are backed by specific criteria required for review, and if decision makers are required to consider the resulting data before deciding to advance a program to the next level.

I = Intent identified in the policy, but sufficient controls not in place by knowledge point.

# Are Effective Controls In Place to Ensure a Knowledge-Based Approach is Followed?

## Knowledge Point 2: Design is stable and performs as expected. Decision to start building and testing production-representative prototypes.

Types of controls considered effective for ensuring knowledge-based approach	Are controls present in DOD 5000 policy?
Complete system critical design review	X
Complete 90 percent of engineering design drawing packages	
Complete subsystem design reviews	I
Demonstrate with system level integrated prototype that design meets requirements	
Complete the failure modes and effects analysis	I
Identify key system characteristics	I
Identify critical manufacturing processes	I
Establish reliability targets and growth plan on the basis of demonstrated reliability rates of components and subsystems	I
Conduct independent cost estimate	
Conduct independent program assessment	
Conduct major milestone decision review to enter system demonstration	I

X = Sufficient controls in place. Controls are considered effective if they are backed by specific criteria required for review, and if decision makers are required to consider the resulting data before deciding to advance a program to the next level.

I = Intent identified in the policy, but sufficient controls not in place by knowledge point.

# Are Effective Controls In Place to Ensure a Knowledge-Based Approach is Followed?

## Knowledge Point 3: Production meets cost, schedule and quality targets. Decision to produce first units for customer.

Types of controls considered effective for ensuring knowledge-based approach	Are controls present in DOD 5000 policy?
Demonstrate manufacturing processes	I
Build and test production-representative prototypes to demonstrate product in intended environment	I
Test production-representative prototypes to achieve reliability goal	
Collect statistical process control data	
Demonstrate that critical processes are capable and in statistical control	
Independent cost estimate	X
Independent program assessment	
Conduct major milestone decision review to begin production	X

X = Sufficient controls in place. Controls are considered effective if they are backed by specific criteria required for review, and if decision makers are required to consider the resulting data before deciding to advance a program to the next level.

I = Intent identified in the policy, but sufficient controls not in place by knowledge point.